Mt. Omei to var. *angustifolia* (Hemsl.) Rehd., while Wilson's no. 4902 from Mt. Omei and no. 2390 from Hupeh are intermediate between var. *angustifolia* and var. *macrophylla* (Hemsl.) Rehd. They also differ in the size of the flowers which are only 12–15 mm. across in Fang's no. 2313, about 2 cm. in Rosthorn's no. 629, and about 3 cm. in Wilson's nos. 4902a and 2390, and in the margin of the sepals which is entire in Fang's specimen and in Wilson's no. 2390, somewhat toothed in Wilson's no. 4902a and very sparingly so in Rosthorn's specimen.

All the specimens seem to have been collected from plants growing wild and not as one might assume from cultivated plants. We also know that the sterile forms of the American *H. arborescens* L. and *H. cinerea* Small now much cultivated have been found originally wild in the woods, while the sterile forms of *H. macrophylla* (Thbg.) DC. and of *H. paniculata* Sieb. have been introduced from the gardens of the Far East into western gardens.

Hydrangea villosa Rehd. f. **sterilis,** f. nov.

A typo recedit floribus omnibus sterilibus inflorescentiam hemisphaericam formantibus.

CHINA. H u p e h : Mts. near Ichang, *E. H. Wilson*, Veitch Exp. no. 1473a, August, 1900 (bush 2–3.5 m.; flowers pinkish).

This is another form with all the flowers sterile of which now quite a number are known belonging including this form, to four Asiatic and to two American species. Like the preceding form it has been apparently collected in a wild state. According to the character of its pubescence it does not belong to typical *H. villosa* but to its var. *strigosior* (Diels) Rehd.

Cotoneaster rotundifolia Wall. var. **tongolensis,** comb. nov.

Cotoneaster disticha var. *tongolensis* Schneider, Ill. Handl. Laubholzk. 1. 745, fig. 419d (1906).—Rehder & Wilson in Sargent, Pl. Wilson. 1. 154 (1912).

CHINA. S z e c h u a n : Tongolo, *J. E. Soulié* (ex Schneider); uplands around Tachienlu, alt. 2600–3000 m., June 1908, *E. H. Wilson*, no. 2186, June 1908 (decumbent bush, 1 m. tall); Baurong to Tachienlu, via Hadjaha, alt. 2750–4650 m., *Herbert Stevens*, no. 338, May–June, 1929.

This variety differs from typical *C. rotundifolia* in the usually more acute or acutish broad-oval or oval leaves pubescent beneath, in the usually slightly pubescent, rarely nearly glabrous calyx-tube, in the flowers being borne often in twos or threes at the end of the branchlets. It may possibly be a distinct species.

Rosa Soulieana Crép. var. **sungpanensis,** var. nov.

A typo recedit foliolis multo majoribus ad 3.5 cm. longis et 2.2 cm. latis, obovatis vel elliptico-obovatis apice saepius fere rotundatis et acuminulatis, crenato-serrulatis vel serrulatis, corymbis multifloris 10–15 cm. diam. sepalis ovato-lanceolatis 12–15 mm. longis, columna stylari in stylos distinctos dissoluta, disco in annulum 1.5 mm. altum producto stylos basi cingente.

CHINA. S z e c h u a n : Sungpan hsien, on side of river, *W. P. Fang*, no. 1525, Aug. 2, 1928 (shrub 2–3 m.; flowers whitish.)

This variety looks at the first glance very different from *Rosa Soulieana*, but agrees in all essential characters with that species except that the leaflets are much larger and the flowers are borne in broad many-flowered corymbs at the end of long vigorous shoots. Dissolved stylar columns are also found occasionally in specimens of otherwise typical *R. Soulieana* as in Wilson's no. 4164 collected between Maochou and Sungpan which also has leaves similar in shape but only 1–1.5 cm. long; the inflorescence is usually only 3-flowered and the disk only little produced above the mouth.

Rosa Stevensii, spec. nov.

Frutex robustus ut videtur; rami robusti ut ramuli glabri, aculeis sparsis rectis 5–10 mm. longis basi dilatatis partim infrastipularibus muniti. Folia pleraque 9-, interdum 11-foliolata, cum petiolo 1.5–3.5 cm. longo 11–13 cm. longa; foliola breviter, terminale longius petiolulata, elliptica, 2–3 cm. longa et 1–2 cm. lata, basi late cuneata, apice acutiuscula vel obtusiuscula et mucronulata, argute simpliciter serrata, supra glabra, subtus pallide viridia ad costam mediam satis dense et molliter, ad nervos laterales sparsius pubescentia, ceterum glabra vel fere glabra, nervis utrinsecus circa 8–10 leviter elevatis, reticulo venularum denso impresso; stipulae conspicuae, 2–2.5 cm. longae et 5–8 mm. latae, auriculis late ovatis, dense stipitato-glanduloso-ciliatae, subtus praesertim ad nervos et venulas glandulosae, ceterum glabrae; petioli et rhachis laxe pubescentia et satis dense stipitato-glandulosa. Inflorescentiae pleraequae 3-florae, basi pauci-bracteatae; flores circa 4.5 cm. lata, purpurea; pedicelli graciles, 2–3 cm. longi, ut hypanthium infra medium aculeolato-setosi setis glanduligeris; hypanthium oblongum apice attenuatum; sepala ovata in acumen longum foliaceum attenuata, integra, petalis plerumque paullo longiora, extus glandulis stipitatis praesertim ad margines exteriores ornata, marginibus interioribus tomentellis exceptis extus glabra intus dense tomentella; petala suborbicularia, extus tomentella; stamina numerosa, filamentis ut videtur purpurascentibus et antheris fuscesentibus (in sicco) 2 mm. longis; capitulum stigmaticum subsessile.

CHINA. S z e c h u a n : Baurong to Tachienlu, via Hadjaha, alt. 2750–4650 m., *Herbert Stevens*, no. 215, May–June 1929 (Kelley-Roosevelt Exped.).

This handsome Rose seems to be most closely related to *R. caudata* Bak., but is easily distinguished by the pubescent leaves, the very large stipules and the petals being tomentulous outside; from *R. Sweginzowii* Koehne and *R. Moyesii* Hemsl. & Wils., to which it seems also related, it differs in the entire sepals, the slender pedicels and the tomentulous petals. The latter character is rather unusual in the genus.

Prunus phaeosticta Maxim. f. **dentigera,** forma nov.

A typo recedit foliis supra medium remote spinuloso-denticulatis denticulis utrinque 2–6 minus longe caudatis, leviter bullatis, nervis subtus magis elevatis.

CHINA. S z e c h u a n : Kikiang hsien, alt. 1050–1375 m., in thickets, *W. P. Fang*, no. 1314, June 11, 1928 (tree 10 m.).

This form looks at the first glance on account of its toothed somewhat bullate leaves rather distinct from the type which has quite entire flat leaves, and is found in southeastern China and in Japan. In western China *P. phaeosticta* seem to be represented only by this and the following form.

Prunus phaeosticta Maxim. f. **lasioclada,** forma nov.

A typo recedit ramulis fulvo-villosulis foliis integris vel partim sparse et minutissime denticulatis.

CHINA. Y u n n a n : Szemao forest, alt. 1500, *A. Henry*, no. 11666 (tree 6 m.; flowers white) (type); without precise locality, *G. Forrest*, nos. 15750, 15802, 17489, 17710, 17721, 17760, 17888, 18112.

UPPER BURMA: hills around Stawgaw, Lat. 26° N., Long. 98° 25′ E., in mixed thickets, *G. Forrest*, no. 26500, in 1924–1925 (shrub 30 ft.; flowers white).

This form differs from the type in its short-villous young branchlets and in the leaves being on the same branch either entire or toward the apex minutely and remotely denticulate; in Henry's specimen and in every one of the Forrest numbers from Yunnan minute teeth can be found at least on a few leaves of every specimen which seems to show that the presence of teeth is a character of the western forms of *P. phaeosticta*, for in every one of the many specimens before me from southeastern China and from Formosa the leaves are quite entire and the branchlets lack the villous pubescence. Forrest's specimen from Burma, however, agrees in its entire leaves with the type and the pubescence of the branchlets is not quite as conspicuous as in the Yunnan specimens.

Ilex latifolia Thbg. var. **Fangii,** var. nov.

A typo recedit folius angustioribus oblongis vel oblongo-lanceolatis vel oblongo-oblanceolatis 9–13 cm. longis et 2.8–4.8 cm. latis utrinque attenuatis apice magis acuminatis minus crasse coriaceis, ramis et ramulis fuscis gracilioribus.

CHINA. S z e c h u a n : Mt. Omei, alt. 1375–1675 m., in thickets. *W. P. Fang*, nos. 3098 and 3144, Aug. 17 and 18, 1928 (shrub 5 m.).

The two specimens cited above which are in young fruit seem to agree in all essential characters with typical *I. latifolia* except that the leaves are smaller and narrower, longer-acuminate and somewhat less thickly coriaceous; also the branchlets are less stout measuring toward the apex only about 2 mm. in diameter. To my knowledge the species has not been found west of Chekiang and Kiangsu, and the Omei plant may therefore be considered a geographical variety and not a mere narrow-leaved form.

Evonymus centidens Léveillé in Fedde, Rep. Spec. Nov. XIII. 262 (1914); Cat. Pl. Yun-Nan, 34, fig. (1915).

Frutex 2-metralis glaber, sempervirens, ramulis glabris gracilibus acute quadrangulatis, annotinis plus minusve verruculosis demum fuscis subteretibus; gemmae terminales parvae, perulis paucis lanceolatis glabris interdum sparsisime fimbriato-lobulatis. Folia opposita, chartacea, brevissime petiolata petiolo canaliculato circa 2 mm. longo, oblonga vel oblongo-lanceolata vel oblongo-oblanceolata, 3–8 cm. longa et 1.1–2.5 cm. lata, argute et dense serrulata dentibus erecto-patentibus glandula parva fusca terminatis, luteo-viridia, subtus pallidiora, costa media supra et subtus elevata, nervis utrinsecus 5–7 supra fere obsoletis subtus prominulis nervis secundariis leviter prominulis conjunctis, venulis obsoletis. Inflorescentiae in parte aphylla inferiore ramulorum hornotinorum vel in apice ramulorum brevium vel e gemmis perulatis axillaribus ramulorum annotinorum, pleraeque triflorae vel 1–2-florae, pedunculo gracili 2–7 mm. longo, pedicellis 2–4 mm. longis; flores 4-meri, circa 7 mm. diam., sepalis semi-orbicularibus, petalis suborbicularibus 2–5 mm. longis et 3 mm. latis leviter vel vix crenulatis, filamentis brevissimis, antheris subglobosis luteis, ovario breviter conico; capsulae solitariae (semper?) lobis fere ad basin partitis ellipsoideis 6–7 mm. longis obtusis, plerumque tantum uno vel duobus rarius tribus evolutis, monospermis; arillus scarlatinus, apertus, semen fere nigrum dimidium tantum vel paullo ultra tegens.

CHINA. Yunnan: "collines broussailleuses à Long-ky," alt. 700 m., *E. E. Maire*, June 1912 ("grand arbuste à feuilles caduques") (type). Szechuan: Nanchuan hsien, in thickets, *W. P. Fang*, no. 5819, Nov. 8, 1928 (shrub 2 m.).

Though the type of *E. centidens* is based on a flowering specimen and Fang's plant from Szechuan is in fruit, I have no doubt that the two specimens are identical, since they agree well in their vegetative characters and in the inflorescence except that the leaves in Maire's specimen are generally larger attaining up to 8 cm. in length, and 2.8 cm. in width, while those of Fang's specimen are not larger than 6 × 2 cm. The leaves are not membranous as described by Léveillé, but distinctly chartaceous or subcoriaceous and at least partly persistent. The species seems to be most closely related to *E. Dielsiana* Loes. from which it differs chiefly in the closely and sharply serrulate leaves, the shorter petioles and the shorter peduncles. It also agrees with *E. Dielsiana* Loes. in its fruit which is very similar to that of *E. alata* (Thbg.) Reg. and of *E. Euscaphis* Hand.-Mazz.; in all these species the fruit is deeply lobed nearly to the base and of the four carpels usually only 1–3 develop, so that the mature fruit is usually 1–3- instead of 4-lobed.

As Léveillé's description is very meagre and based only on flowering material I have given above a full description of the species, based on Maire's flowering and Fang's fruiting specimens.

Microtropis fokienensis Dunn in Jour. Linn, Soc. XXXVIII. 357 (1908).—Dunn & Tutcher, Fl. Kwangtung (Kew Bull. Add. Ser. x. 61 [1912]).

CHINA. Fukien: Yenping, alt. 1500 m. *S. T. Dunn*, April to Nov. 1905, (Hongkong Herb. 2394; isotype). Kwangtung: Swatow district (ex Dunn & Tutcher). Chekiang: Tientai shan, Huating, *C. Y. Chiao*, July 23, 1927 (Herb. of Univ. Nanking no. 14480). Szechuan: Nanchuan hsien, in thickets, *W. P. Fang*, no. 5756, Nov. 5, 1926 (shrub 4 m.).

This species had been known before only from southeastern China, where it has been collected in Fukien, Kwangtung and Chekiang. The Szechuan plant differs only slightly from the type in the longer peduncles and pedicels, the former being 5–7 mm. long and the pedicels of the lateral flowers of the 3-flowered cyme being up to 3 mm. long, while the terminal one is subsessile; also the leaves are longer and narrower being up to 7 cm. long and 1.6–2 cm. wide, while in the type they are up to 6 cm. long and 2–2.8 cm. wide. The Chekiang specimens resembles the Szechuan plant in its leaves, but has the short peduncles and pedicels of the type.

Eurya Fangii, sp. nov.

Frutex metralis, ramis suberectis ramulis hornotinis satis dense strigoso-pilosis vel setoso-pilosis tertio anno glabrescentibus. Folia persistentia, subcoriacea, brevissime petiolata petiolo 1–2 mm. longo glabro, elliptica vel oblongo-elliptica, 2.5–3.5 cm. longa et 10–14 mm. lata, basi cuneata, apice breviter obtuse acuminata, minute serrulata dentibus mucrone acuto incurvo terminatis, supra atroviridia, subtus flavo-viridia, glabra, costa supra incisa subtus elevata, nervis utrinque 6–8 supra leviter impressis subtus prominulis, venulis supra obsoletis vel levissime impressis subtus leviter elevatis. Flores (alabastra tantum visa) in axillis foliorum solitarii; pedicelli glabri, 1–2 mm. longi; bracteae 2, suborbicularia, 0.5–1 mm. longae, majore minute ciliolata; sepala late ovata, 2 mm. longa, obtusa, minute ciliolata. Baccae subglobosae, circiter 5 mm. longae; semina numerosa, suborbicularia, circa 1.25 mm. diam., leviter compressa, rubro-brunnea.

CHINA. Szechuan: Omei hsien, Mt. Omei, in thickets, alt. 2600–2750 m., *W. P. Fang*, no. 2917, Aug. 13, 1928 (shrub 1 m.).

This new species seems to be most closely related to *E. japonica*, but differs chiefly in the hirsute branchlets, the smaller leaves with impressed veins above and the ciliolate sepals.

Stachyurus yunnanensis Fr. var. **obovata,** var. nov.

A typo recedit foliis tenuioribus, obovatis, infra medium basin versus sensim in petiolum attenuatis apice subito in acumen 1–1.5 cm. longum productis, 5.5–7.5 cm. longis et supra medium 2–3 cm. latis.

CHINA. Szechuan: Kuan hsien, alt. 1075 m., in woods, *W. P. Fang*, no. 2000, July 4, 1928 (tree 4 m.).

This plant looks at the first glance very distinct on account of its

obovate almost lyrate caudate-acuminate leaves, but the leaves of some specimens of *S. yunnanensis* before me show a tendency toward an obovate shape and the serration agrees with that of *S. yunnanensis*. As the flowers are unknown, the specimen bearing young fruits, it does not seem wise to describe it as a new species.

Schefflera Bodinieri, comb. nov.

Heptapleurum Bodinieri Léveillé in Bull. Acad. Intern. Geog. Bot. XXIV. 144 (1914); Fl. Kouy-Tchéou, 35 (1914).

Frutex; ramuli initio farinaceo-puberuli mox glabrescentes, annotini pallide rubro-brunnei. Folia longe petiolata petiolo gracili terete 8–15 cm. longo glabro, digitata; foliola membranacea, plerumque 7–9, interdum 5–6, inaequaliter petiolulata petiolulis glabris infimis brevissimis 1–2 mm. longis, terminali 1.5–5 cm. longo, ceteris intermediis, inferiora ovata-lanceolata vel lanceolata, 4–7 cm. longa et 1–1.6 cm. lata, terminale lineari-lanceolata, 10–16 cm. longum, 1–2.5 cm. latum, cetera intermedia, basi late cuneata vel interdum fere rotundata, sensim longe acuminata, remote sparseque denticulata denticulis utrinque 1–8, rarius integra, supra atroviridia, subtus glauca et initio sparsissime farinaceo-puberula, mox fere glabra, costa media supra prominula, subtus elevata, nervis utrinsecus 8–16 fere obsoletis. Inflorescentia pedunculo circa 1 cm. longo incluso 7–11 cm. longa, umbellulis 6–7 multifloris globosis circiter 2 m. diam., racemosa vel axi laterali inferiore iterum racemoso paniculata, farinaceo-puberula; pedunculi umbellularum 1–2 cm. longi, bi-bracteolati bracteolis parvis plerumque infra medium pedunculi insertis et saepe gemmam abortivam in axilla gerentibus; pedicelli 2–5 mm. longi, graciles, farinacei; calycis margo 5-denticulatus denticulis discum superantibus; petala 5, oblongo-ovata, 3–3.5 mm. longa, acutiuscula, reflexa, extus sparse farinacea; stamina 5, petalis paullo longiora; discus annularis crassus; stylus 1–2 mm. longus, striatus, stigmate punctiformi indiviso coronatus; ovarium 5-loculare, extus farinaceo-puberulum. Fructus non visi.

CHINA. Kweichou: "district de Tsin-gay, vallée de Kia-la-tchong," *J. Laborde* in herb. Bodinier, no. 2459, Dec. 21, 1897 ("grand arbuste") (syntype); "environs de Kouy-yang, mont du Collège," *E. Bodinier*, Sept. 1898 (flowers), Feb. 17, 1898 (fruit) (ex Léveillé) (syntype); "route de Pin-fa à Kouy-tin," *J. Cavalerie*, nos. 747, 3098 (syntype), Oct. 1 and Dec. 4, 1902 (ex Léveillé); Long-ly, *J. Cavalerie*, no. 1567, Sept. 1897. Szechuan: Nanchuan hsien, woods, *W. P. Fang*, no. 5740, Nov. 4, 1920 (shrub 1–2 m.).

This species is apparently related to *Schefflera octophylla* (Hance) Harms and *S. hypoleucoides* Harms but is easily distinguished by the smaller and narrowly linear-lanceolate remotely serrulate membranous leaflets and the much smaller inflorescence. It also resembles *Brassaiopsis speciosa* Dcne. & Pl. from which it differs in the same characters and in the 5-celled ovary. As Léveillé's description is very brief and incomplete, I have given above a detailed description based on Laborde's no.

2459 which may be considered the type, on Cavalerie's no. 1567 and Fang's no. 5740.

Vaccinium conchophyllum, sp. nov.

Frutex sempervirens, ut videtur semiprostratus, 20–30 cm. altus, ramis crassiusculis; ramuli angulati, breviter patenti-pilosi, brunnescentes, vetustiores glabrescentes, grisei. Folia crasse coriacea, satis congesta apicem versus fere imbricata, brevissime petiolata petiolo 1–2 mm. longo glabro, late ovalia vel late obovato-ovalia, 8–14 mm. longa et 6–9 mm. lata, apice rotundata basi late cuneata vel rotundata, margine initio ciliato hyalino integro recurvo, ideo folia subtus plus minusve concava, supra initio laxe villosa mox costa media villosula excepta glabrescentia, reticulato-rugosa, subtus laevia, pallide viridia, ab initio glabra, costa media supra impressa sed basin versus prominula subtus levissime vel vix elevata, nervis utrinque 3–4 supra impressis subtus obsoletis. Flores rubri, in racemis 4–6-floris axillaribus solitariis vel paucis in apice ramulorum brevibus; rhachis glabra; bracteae oblongae, glabrae, pedicellis 1–2 mm. longis glabris longiores, caducae; sepala triangulari-ovata, 1.5 mm. longa, acuta, ovario paullo breviora, glabra; corolla ovoideo-urceolata, 5 mm. longo, lobis triangularibus brevissimis reflexis; stamina 10, filamentis latis pilosis 2 mm. longis, antheris 2-tubulosis glabris, in dorso ad apicem filamenti 2-aristatis aristis dimidios tubulos aequantibus; stylus glaber, staminibus subaequilongus. Fructus deest.

China. Szechuan: Nanchuan, alt. 2450–2750 m., in thickets, *W. P. Fang*, no. 849, (type) May 20, 1928 (bush 1 foot; flowers red).

This new species is apparently most closely related to *Vaccinium Nummularia* Hook. f. & Thoms. from Sikkim which is easily distinguished by the dense hispid pubescence of the branchlets, the hairs partly exceeding the diameter of the branchlets, by the pubescent rhachis of the usually larger inflorescence, and by the serrulate broadly ovate rather than broadly oval-obovate leaves with rounded or even slightly subcordate base; Hooker describes the leaves as subentire, but on Griffith's and his own specimens and on Schlagintweit's no. 14755 they are distinctly though minutely serrulate with mucronulate teeth.

Styrax Huanus, spec. nov.

Arbor 6–15-metralis; ramuli juniores pilis stellatis vestiti; annotini glabri, fusco-brunnei, cortice in lamellas tenues soluta. Folia alterna vel inferiora subopposita, petiolata petiolo 4–10 mm. longo stellato-piloso, elliptica vel elliptico-oblonga, interdum obovato-elliptica, 7–11 cm. longa et 3–5.5 cm. lata, basi cuneata, acuminata, minute denticulata supra obscure viridia, costa nervisque stellato-tomentosulis exceptis glabra vel fere glabra, interdum leviter rugulosa, subtus dense albido-stellato-tomentosa, utrinque nervis 6–8 angulo acuto divergentibus supra leviter vel vix impressis subtus elevatis ante marginem anastomosantibus. Inflorescentia fulvido-tomentosa, racemosa, terminalis, plerumque basi

1 vel 2 racemis ex axillis foliorum ortis aucta; racemi 7–12 cm. longi, 8–16-flori vel laterales minores; rhachis stellato-tomentosula; bracteae subulatae, pedicello breviores vel paullo longiores, rarius infima foliacea; pedicelli circa 5 mm. longi; calyx campanulatus, circa 5 mm. longus, extus dense fulvido-tomentosus, intus minute stellato-pubescens, basin versus glaber lobis late triangularibus 1–2 mm. altis acuminulatis; corolla 5-partita, tubo circa 5 mm. longo, lobis aestivatione imbricatis, elliptico-oblongis vel spathulato-oblongis, 12–14 mm. longis, 5–6 mm. latis, acutiusculis extus dense stellato-tomentosis intus sparsius pilis stellatis obtectis; stamina 10, tubo medio adnato, lobis paullo breviora, parte libera plana glabra circiter 8 mm. longa, antheris 4 mm. longis ad marginem sparsissime stellato-pilosis; stylus staminibus longior, lobos fere aequans, glaber; ovarium globoso-ovoideum, villosum semi-inferum, multi-ovulatum.

CHINA. Szechuan: Nanchuan hsien, alt. 1200–2700 m., in thickets and woods, *W. P. Fang*, no. 1376, June 3, 1928 (type), no. 1133 and 1401, May 29 and June 4, 1928 (tree 6–15 m. high).

This new species seems closely related to *S. Hemsleyanus* Diels with which it agrees in general appearance, size and shape of the leaves, inflorescence and size of flowers, but from which it is easily distinguished by the dense white stellate tomentum of the under side of the leaves and also in the longer and glabrous filaments. It also resembles *S. rugosus* Kurz from Burma which differs chiefly in its more rugose leaves, much longer calyx-teeth, 6-parted corolla and superior ovary, and the North American *S. grandifolius* Ait. which has broader usually entire leaves, white-tomentose calyx nearly glabrous inside, and the filaments pubescent below.

I take pleasure in associating this handsome shrub with the name of Dr. H. H. Hu, Professor of Botany at the Fan Memorial Institute, Peiping.

Lonicera saccata Rehd. f. **calva,** forma nov.

A typo foliis utrinque glabris recedit.

CHINA. Szechuan: Nanchuan hsien, alt. 2500–2750 m., in thickets, *W. P. Fang*, no. 845 (type), May 20, 1928 (shrub 4 m. tall; flowers white); summit of Nin tou shan, west of Kuan hsien, alt. 2750 m., *E. H. Wilson*, no. 1862 (in part), June 20, 1908.

Fang's no. 845 agrees in all its characters except in the lack of pubescence with the type. The corolla is distinctly saccate and the leaves are obovate-oblong with the veins yellowish beneath. Wilson's no. 1862, in this herbarium, consists of two branches, one with glabrous leaves and one with the leaves thinly pubescent beneath; the corollas on both branches are gibbous rather than saccate. The new form also approaches *L. aemulans* Rehd. which differs chiefly in its smaller obovate leaves, shorter pedicels and smaller flowers with gibbous, not saccate corolla.

THE PHYTOPHTHORA DISEASE OF THE CALLA IN AMERICA

KENNETH S. CHESTER

IN the early part of January of this year, my attention was called to a diseased condition of the cultivated Calla Lily, *Zantedeschia aethiopica* Spreng. (*Richardia aethiopica* Hort.), in a greenhouse in Martha's Vineyard, Mass. About one hundred plants were being reared for cut-flower purposes, and all showed to a pronounced degree the effects of a severe blight. The plants were stunted, none of the blossom stalks was over two feet in length, and some were less. Many of the leaves were completely dead, and others were dying from the margins inward. A few of the blossoms were of perfect appearance though small, but most of them showed a browning of the distal portion of the spathe, ruining the commercial value. The symptoms pointed to a root or nutritional derangement. On knocking out the earth ball, a few excellent young roots were seen, but the great majority were either partly or completely rotted with only the papery root-sheath remaining, or were entirely absent with the impression of the root left in the soil. Both new and dead roots came from the same region of the corm. The partly-affected roots showed a glassy, translucent, water-soaked appearance between the normal portion and that completely rotted. Associated with the glassy appearance of the roots was a slight red discoloration in spots. The corms themselves showed various degrees of rot. In some only the lower end of the corm was decayed, in others half or more than half was brown and mushy. In the worst cases the whole corm was completely rotted away within the outer shell, and the base of the stalk could be pushed into the mushy mass. Even in these last cases, however, the top was partly green, and a few good roots were attached to the base of the stalk.

The course of the disease is a slow wasting one. The plants do not die immediately, but continue in a state of reduced vitality to produce sickly, non-marketable blossoms.

Believing that this trouble might be due to unfavorable physical or chemical soil conditions, the propagator carried out a set of experiments in an attempt to ameliorate the blighted condition. Thirty pots, each of three plants, were treated with varying amounts of water, lime, liquid hen manure, soot, and bone meal, in addition to the usual "liquid feed." But no improvement resulted, for all, including the control plants, showed the effects of the disease to the same extent when examined several months later. It was at this stage that the diseased Callas came under my observation.

The general symptoms indicated that the disease was of a biotic rather than abiotic cause, and microscopic investigation at once revealed the presence of a fungus. The next step was the isolation and identification of the fungus. The glassy roots of several plants were washed and placed in a little water in moist chambers. *Phytophthora* sporangia developed

in abundance from cortical ruptures in the glassy region after 24 hours, and after 48 hours had proliferated and liberated zoospores in abundance. Four months later the same technique was repeated with the same plants and the same results obtained. Examination of the sporangia showed them to be the centrally proliferating type described by Buisman (2) for *Phytophthora Richardiae* Buis., a virulent parasite of the Calla in Europe. In appearance and size the sporangia and zoospores were in conformity with Buisman's description, while the symptoms corresponded precisely to those seen in Europe. It so happened that Dr. Buisman was working in the Arnold Arboretum at the time, and when shown the diseased plants and the cultures of the fungus she expressed no doubt that the disease is identical with the European disease caused by *Phytophthora Richardiae*.

The Calla disease was first observed by Buisman in Holland in the few years prior to 1927. It was noted for the first time in England in 1927 by Salmon and Ware (3) and found to be identical with the Dutch disease. Incidentally it may be mentioned that Ashby (1), after a study of the fungus that causes the disease in Europe, has expressed the opinion that it is a variety of *Phytophthora cryptogaea* Pethyb. & Lafferty (var. *Richardiae* Buis.) since the differences between the Calla fungus and *Ph. cryptogaea* are mainly quantitative with respect to size of sporangia and oogonia and since recent work on *Phytophthora* has shown wide variation in size of these organs within the same species. It is of more than passing interest to record that this disease has just been reported (since this manuscript was prepared) by Weiss from America (4). Weiss notes its occurrence in New York, New Jersey, and probably in California.

Turning to the question of control, it is very satisfying to note that Buisman found that formalin treatment was effective in control, and her method was essentially followed with satisfactory results by Salmon and Ware. This method was recommended to the propagator at Martha's Vineyard and the developments fulfilled expectations. The technique is as follows: The corms are taken from the soil and all rotted parts are excised. It is essential to cut back the roots rather severely, as the fungus is present in some cases in apparently healthy roots. The corms are washed thoroughly in running water and then soaked for one hour in a weak solution of formalin (one part commercial formalin to fifty parts water). Fresh pots and uncontaminated soil are employed in repottimg the corms, and effective disposition is made of all contaminated soil and other waste from the plants. The pots formerly containing the diseased plants may be rendered safe for use by washing in a 1:20 formalin solution or by baking in an oven.

In January of this year every one of the one hundred plants in the greenhouse mentioned above was found to be affected, and they showed hardly a single marketable blossom. At this time the diseased parts were excised and the corms treated with formalin as indicated above. In

spite of the setback attendant on cutting back the roots and repotting at the height of the blossoming period, four months later the disease had been materially reduced and the plants bore numerous healthy blossoms. The propagator, who in January was at the point of discontinuing the rearing of the Calla, was entirely optimistic regarding their culture at the end of the four month period following the formalin treatment.

Weiss does not give specific data with regard to the use of formalin as a disinfective measure, but his experiments with chemical agents, particularly soaking the corms in 1:1000 mercuric chloride solutions, were followed by indifferent results thus far. However his experiments are being continued.

The *Phytophthora* disease of the Calla, as far as is known, has not been reported in America previous to this year, and it is important to discover the possible source of the disease. As to the infection reported here from Massachusetts, it is known that the diseased corms were purchased from a large wholesale importing firm. Since many of our corms are brought in from Europe, it is reasonable to suspect that the disease was brought to America in shipments from Europe. Weiss' observations and those reported above show that the disease is already distributed in the East. I have had occasion to be in contact with the Boston flower market for a number of years, and during that time no indication of the disease as manifested through scarcity of good blossoms has come to my attention. With the knowledge of the strong possibility of the epidemic spread of diseases caused by *Phytophthora* of whatever species, the recognition and the eradication of the Calla disease are earnestly recommended before it increases to unwieldy proportions.

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A PLANT COLLECTOR'S NOTES ON THE NEW HEBRIDES AND SANTA CRUZ ISLANDS[1]

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I left Sydney on the 1st February, arriving at Vila on the 11th, calling at Lord Howe Island and Norfolk Island en route. The first glimpse I got of Vila Harbour was very pretty and I was struck by the fresh vivid green of the foliage flanking the different colored coral waters of the harbor. To this the little town of Vila presents a strong contrast, as it consists of a row of squalid buildings in the main street which does not look very pleasing. There is no sanitation, water, electric light or other conveniences. Mosquitoes are bred plentifully in the empty tins lying around, the food of the inhabitants like in most tropical towns consisting largely of canned goods.

There is no decent hotel, as the one existing before was sold to the Condominion Government to be made into a lands office. The only other hotel is a small French one, which caters for all classes and colors. Plenty of bars, little evil places, built after the style of a small kiosk, many of them unregistered, sell alcoholic drinks to all classes and colors. The liquor is amazingly cheap, as there is a very small custom duty on it.

The Government is a joint dual control of England and France, which is not satisfactory to either party. Earthquake shocks or tremors are often felt, but as a rule do very little damage. There are three active volcanoes in the group, on the islands of Tanna, Ambrim and Lopevi.

From Vila the first island visited southwards was Erromanga, which is a remarkable island in many respects. This island has an elevated grassed plateau about 900 to 1200 feet above sea level and on this plateau an Australian gentleman, Mr. Martin, has a sheep station. It is a wonderful thing to see sheep doing so well in the tropics. On this plateau can be seen old coral formations everywhere on the surface. The coral is in a wonderful state of preservation, many different types being recognizable, also coral boulders, referred to throughout the islands as niggers heads. This proves conclusively, that a shelf of the sea was upraised by a volcanic disturbance.

The area of the grassed plateau is not very large and only occupies a small part of the island. The natives on this island in the early days were very savage and treacherous, having the reputation of being the fiercest of the whole of the natives of the New Hebrides. Altogether they killed four missionaries, but I think it was through their mistrust

[1] Mr. S. F. Kajewski collected for the Arnold Arboretum from Feb. 11, 1928, to March 20, 1929, in the New Hebrides and on Vanikoro of the Santa Cruz Islands. The following summer and autumn he spent in North Queensland collecting, and after regaining there his health which had been impaired by fever while in the New Hebrides, he went to the Solomon Islands where he is now continuing his work for the Arboretum. The plants collected in the New Hebrides are being determined by Dr. A. Guillaumin of Paris and partly by specialists; of this collection we expect to publish an enumeration in this Journal some time next year.—Eds.

of all white men at that time, as the sandalwood traders and blackbirders were cruel and inhuman in their treatment to the natives.

Erromanga has no harbors and the only anchorages are bays on the leeward side of the prevailing wind. The anchorage where I stayed at Dillons Bay is very pretty. The Williams River flows through a gorge over 700 feet deep, with a luxuriant rain forest growth down the sides and in the bottom. This coupled with the very clear waters of the river makes a beautiful sight indeed. Mr. Rae, the Presbyterian missionary there, was very kind, supplying me with boys and giving me every possible assistance.

Although a small island it has four distinct classes of soil distribution. The first is the tropical rain forest which is the same throughout all the islands, since close to the sea the strand flora is much the same. This type of rain forest is usually never very high, as cyclones, strong trade winds and its continual destruction by the natives in the past for gardens, have spoiled the conditions necessary for a tall rain forest.

The next formation on Erromanga is at 700 to 800 feet above sea level, which is of coral formation with coral boulders projecting everywhere. This is beautifully grassed and is open pasture country, with numerous ravines and well grassed steep hills. Clumps of Wattle (Mori) are growing everywhere, the Wattle being closely allied to *Acacia Cunninghamii*. The only drawback is that on account of the good soil and high rainfall, the grass tends to grow too rank and a growth of from 60 to 80 centimetres is quite common with sheep grazing over it all the time. Where sheep have no access the height is much greater running well over a metre. The sheep keep in excellent condition, many being sold locally in the islands for mutton, while the wool realizes good prices. The annual rainfall of the Island is over 70 inches.

The next formation is a little higher, 800 to 1500 feet, and consist of poor red clay soil, which marks the end of the coral formation. This formation is undoubtedly much older than the coral formation and like on all poor soil, bracken is very plentiful. The soil seems to be very porous and the leaves of the smaller trees and shrubs are thick, tough and have a dull color, evidently an adaptation of the plants to hold their own against the dry porous nature of the soil.

The last formation is the elevated rain forest on the slopes of mountains and small elevated plateaus. This contains many forms common in the coastal rain forests, but also has many trees peculiar to its elevation, which are quite large and of good proportions. In fact, the tallest trees are found on this area, the soil being very rich, mainly red or chocolate colored. Kauri Pine trees occur in this belt in ones and twos, but they are not common.

Seeing that the natives have a number of plants that they use for poisoning fish, I was determined to test the efficiency of these poisons. Taking my boys with me, we crossed to a place where some holes in the

reef had been left full of salt water after the tide had gone out. They went into the bush and cut bundles of a vine that was growing close by and brought them to the edge of the pool. I found out that they use a number of plants for this purpose and I have marked on the label every plant that I know is used for this purpose. With a stone each man beat the pieces of vines into shreds, and kept beating and soaking them alternately. When a bundle of crushed vine is put in the water, it quickly changes the color of the water in the vicinity to a milky color.

As the pool was of a large size about 56 lbs. of vine was used, some of it as thick as a man's wrist, others being much smaller. A small leguminous plant was also used in a similar manner.

After a quantity of the vines had been added the water became very cloudy and the fish came to the surface and darted aimlessly about. I saw several fish swim and leap right out of the water to get away from the substance that was poisoning them and lie struggling on the coral, being easily picked up by hand. Others sink to the bottom without coming to the surface as is popularly supposed. Some float and swim aimlessly about and are easily speared or shot with bow and arrow. The natives tell me that a good many die and remain hidden in the coral ledges under the water. When I asked them why they did not dive into the water for the fishes, they said it was bad for the eyes. I could not persuade any of them to jump into the pool, so I cannot say whether the water has any bad effect on human beings.

Erromanga has been noted for the quality and quantity of the sandalwood exported from its shores. Many lives were lost by both white and black and much suffering and misery caused through it. The natives have for generations used the sandalwood along with any other wood for firewood and had no idea of its value until the foreigners came and asked for the wood. The only price at first given for a big boat load of wood was a small piece of hoop iron three to four inches long, which was greatly prized by the natives since they only had stone axes.

Very often a rascally sandalwood trader would get his ship filled by showing all kinds of articles for barter and when his ship was filled with wood, would clap on all sail and go away laughing, giving the natives nothing. It is no wonder that the natives were so ferocious and bitter against the white man. Many innocents suffered including two missionaries, one missionary and his wife and one assistant missionary. Many other white men, rough diamonds of that period, no doubt also perished, besides numerous natives, often shot for little reason.

From 1820 to 1870 $875,000 worth of sandalwood was gathered, and that figure would be tremendously increased at present prices. There is very little sandalwood left on the island and that is inaccessible. The natives are now carrying the wood on their backs 15 miles to the nearest trader. The reason why any sandalwood is left at all, is that the wood must be very old to be of any value, as the older the wood the higher the

content of oil. As the trees flower when they are about seven years old, a small quantity have survived. The seeds do not seem to carry well and fail to germinate away from their own island.

From Erromanga the next island south is Tanna and I was there the guest of Mr. Nicol, the district agent. The native population is fairly large being about six thousand and Mr. Nicol takes a genuine interest in the natives, and this is one of the few islands where the population is increasing. Mr. Nicol rules with a fearless hand, suppressing grog and silly customs that are against the principles of civilization. Tanna has an active volcano which erupts regularly every three minutes and you can look for a cloud of smoke after these intervals. Of course sometimes it is much quieter than at others, but the periods remain the same. Captain Cook noted this particularity when voyaging down the coast and it has remained so to this day. Such an island is naturally very fertile, as it is continually getting a rich dressing of volcanic ashes, and marvelous crops are grown with very little cultivation.

The rain forest is thick but not very tall, one peculiarity I noticed was the absence of Lawyer vines, *Calamus sp.* The most conspicuous fact in the flora of Tanna is the marvelous number of different kinds of Figs growing there, from noble Banyans, that cover upwards to an acre, to a small one that does not grow more than three metres high.

I must say a little here about native superstition, which fifty years of missionaring has not stamped out. Quite recently after an epidemic of measles and dysentery, which caused many deaths, the natives were suspicious of some one causing all the mischief and accordingly set to work to trace the author. Consequently every day they held meetings and heard what witnesses had to say, and like a chain they kept dragging fresh persons into it, in a manner similar to a political scandal. All the happenings of the island for a number of years were recalled and memories had to work overtime to deny or assert facts. Practically the whole male population was represented as I saw many bushmen or heathen, with long plaits of bushy hair and almost nude. They were very fine men physically, most of them being six feet in height.

It is a very fine sight to see a crowd of eight hiundred natives, all men, seated on the grass and one man at a time talking. As there are four different languages on Tanna there are some men translating all the time. When one man has finished, one man of the opposing side gets up to contradict what he said and so the proceedings go on for days. Personally I think the men enjoy it as it is a welcome break in their lives, since they have not too much to do, making their wives do all the work. It must be interesting how they record the evidence as there are no shorthand writers, but the decision of the chiefs is final.

The next place we passed on to was Aneityum, the most southerly island of the group and having the distinction of being the first one of the group to be settled by missionaries. The first glimpse one gets of

Aneityum is very pretty and the wonderful harbor flanked by the coral and different colored waters is indeed beautiful. One does not get a good impression of the timber wealth of the island as the Kauri tops are not silhouetted against the skyline like at Vanikoro. Instead one sees a succession of poor red soil ridges, that lead up to the higher rain-forest hills and mountains, where the Kauri pine is found.

These red soil ridges are covered with Bracken and stunted shrubs, the soil being very poor. It seems to have been red mud spouted out of geysers and assumed a gravel-like texture, being very porous. It covers quite a large area of the island which differs in this respect from Vanikoro, where there is only a small proportion of waste land not covered by Kauri.

The climate of Aneityum is decidedly cool compared with the other islands, the temperature in the hot season staying between 75 and 90 degrees all the time, going down to 75 only at night.

There is a striking similarity of the vegetation of Vanikoro and Aneityum in regards to ferns and small trees. Both islands in addition to the flora of the tropical coral formation islands have a flora much older and distinctly different, growing on the red volcanic soil hills, including the wonder trees of the Pacific, the Kauri. In addition a *Podocarpus* found in the Eastern Malay Archipelago is also found there. Aneityum has not as many Orchids as Vanikoro, owing to the lower rainfall and cooler climate.

The Kauri on Aneityum (*Agathis obtusa* Mast.) seems to be very similar to that on Vanikoro (*Agathis macrophylla* Mast.). On Aneityum I think there are more species of commercial timbers than on Vanikoro.

The native population is fast decreasing owing to a variety of causes. The Aneityumese are a much lighter skinned race than the rest of the natives of the New Hebrides and are a pleasure loving crowd always laughing. Only 250 natives remain today out of an estimated former population of six thousand people. The remains of a church is still standing on one side of the Island, that would accomodate two thousand people and even that, it is said, had been far too small.

The decrease had set in before the missionaries came, as there was a whaling station there and other traders visited the island in search of sandalwood. These men brought all kinds of diseases and the native had not the constitution to stand against them, consequently they melted away before their inroads. Happy Aneityumese, they bear no malice against the white man, who has been responsible for nearly wiping them out. The birthrate is lower than the death rate and has been so since records were kept by missionaries. The men are twice as numerous as the women and infantile mortality is very high, yet an orphan finds a number of people always willing to adopt it.

THE NORTHERN GROUP OF THE NEW HEBRIDES

The whole of the New Hebrides group lies between 10 degrees and 22 degrees and consequently within the tropics. The rain forest formation is